EFFECTIVENESS OF WRIST MANIPULATION VERSUS TRADITIONAL PHYSIOTHERAPY IN THE MANAGEMENT OF LATERL EPICONDYLITIS IN SPORTS PERSONS – A COMPARATIVE STUDY

Registration Number

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A DISSERTATION SUBMITTED TO

THE TAMIL NADU DR. M. G. R. MEDICAL UNIVERSITY, CHENNAI,

IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE

DEGREE OF MASTER OF PHYSIOTHERAPY

APRIL 2011

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CERTIFICATE

This is to certify that the project entitled **EFFECTIVENESS OF WRIST MANIPULATION VERSUS TRADITIONAL PHYSIOTHERAPY IN THE MANAGEMENT OF LATERL EPICONDYLITIS IN SPORTS PERSONS – A COMPARATIVE STUDY** and was work done by **Mr. S. PRAKASH**, a bonafide student of Master of Physiotherapy (M.P.T.) Final Year student under The Tamil Nadu Dr. M.G.R Medical University, Chennai.

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COLLEGE OF PHYSIOTHERAPY
TRINITY MISSION AND MEDICAL FOUNDATION
ULTRA TRUST
MADURAI
TAMIL NADU

***Examiners:*____**

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CONTENTS

1. INTRODUCTION

Lateral epicondylitis ("tennis elbow") is characterized as pain on the lateral side of the elbow that is aggravated with movements of the wrist, by palpation of the lateral side of the elbow, or by contraction of the extensor muscles of the wrist. Lateral epicondylitis is a soft-tissue lesion affecting men and women equally, with a reported incidence of up to 3% in the population and a peak occurrence in the fifth decade. Despite the commonly used term 'tennis elbow', fewer than 5% of sufferers play regular predisposing sport, although up to 50% of regular tennis players are said to be affected at some time in their playing life. Symptom development is felt to occur in the contralateral arm as a result of favouring this limb.

Development of lateral epicondylitis is usually insidious, although the onset may result from strenuous overuse relating to particular repetitive actions. The duration of lateral epicondylitis is highly variable, ranging from 3 weeks to several years. With the avoidance of aggravating factors, most cases resolve spontaneously within 12 months. There is currently no consensus on the optimum treatment, but numerous options are available. A significant number of treatments are offered for lateral epicondylitis, ranging from medical interventions such as medication, surgery and use of orthotic devices to physical therapy including modalities, exercise, and manual therapy including advising patients that the condition is self-limiting and providing encouragement. However interventional studies of this disorder have been disappointing and evidence is lacking for the long-term benefit of physical therapies.

1.1 NEED FOR THE STUDY

Given the complexity surrounding the identification of an underlying cause, it is not surprising that no agreement exists as to which method is most effective in treating this disorder. In addition, evidence regarding treatment effectiveness for lateral epicondylitis is also lacking. A review conducted by Labelle et al. In 1992 concluded that evidence was lacking to support any current treatment and that the existing studies were of low quality. An updated review by Smidt et al in 2003 shared similar conclusions to those of Labelle et al. Most recently, a review conducted by Bisset et al. highlighted initial benefits provided by manipulative therapy and concluded that further studies were warranted. Manipulation has been a recommended treatment for lateral epicondylitis since the 1920s, beginning with techniques advocated by Mills and Cyriax. Further manipulative techniques include Kaltenborn and Stoddard's varus thrust, Mennell's extension thrust, and Mulligan's mobilization with movement. Given the history of manipulation's role in treating lateral epicondylitis combined with Bisset et al's conclusions, studies focusing on the role of manipulative therapy is indicated.

Manipulation of the wrist also has been described previously; however, its effectiveness for management of lateral epicondylitis has not been demonstrated. The purpose of this study was therefore to compare the effectiveness of manipulation of the wrist with the effectiveness of an intervention consisting of friction massage, ultrasound, and muscle stretching and strengthening exercises for the management of lateral epicondylitis in sports persons.

2. LATERAL EPICONDYLITIS

2.1 DEFINITION

Tennis elbow (also known as "shooter's elbow" and "archer's elbow") is a condition where the outer part of the elbow becomes sore and tender. It is commonly associated with playing tennis and other racquet sports, though the injury can happen to almost anybody.

The condition is also known as lateral epicondylitis ("inflammation of the outside elbow bone"), a misnomer as histologic studies have shown no inflammatory process. Other descriptions for tennis elbow are lateral epicondylosis, lateral epicondylalgia, or simply lateral elbow pain.

Runge is usually credited for the first description in 1873 of the condition. The term tennis elbow was first used in 1883 by Major in his paper "Lawn-tennis elbow".

2.2 ETIOLOGY

Lateral epicondylalgia or tennis elbow is a common cause of pain and disability. It is characterized by pain and tenderness centered around the lateral epicondyle. The source of the pain was initially thought to be due to extensor carpi radialis brevis degeneration. However, it is now recognized that the lateral epicondyle, the annular ligament, the radial head and the capitellum may also contribute to the experience of pain in tennis elbow.

Several factors have been implicated in the causation of tennis elbow. These include

- Overuse of the affected limb,
- Repetitive forceful movements,
- Training errors,
- Misalignments,
- Flexibility problems,
- Ageing,
- Poor circulation,
- Strength deficits and muscle imbalances.

2.3 PATHOPHYSIOLOGY

The exact underlying pathological process contributing to lateral epicondylitis has been the topic of much debate, and there still exists no consensus. Current evidence following surgical intervention indicates that is lateral epicondylitis a chronic disorder demonstrated by the presence of degenerative changes, such as increased fibroblasts and disorganized collagen, as opposed to inflammatory cells. These findings are contradictory to the widely used term epicondylitis, which describes an inflammatory condition. It has recently been recommended that the term epicondylitis be replaced with epicondylosis, a more accurate descriptor of the underlying degenerative process, or the generalized term epicondylalgia.

2.4 SPORT-SPECIFIC BIOMECHANICS

Tennis is the most common sport to cause lateral epicondylitis, but the condition can also be seen in those who play squash and badminton. Symptoms can occur after an improper backhand hitting technique, which can occur when the athlete attempts to increase power by increasing forearm force rather than relying on core, rotator cuff, and scapular power. This results in snapping the wrist with supination and irritation of the extensor tendons. Symptoms can also occur when an athlete does not get his or her feet into position and hits the ball late or with a bent elbow. The power of the hit is again generated from the forearm instead of the core. Other causes of extensor tendinopathy in tennis are using a new racquet, using a racquet that is strung too tightly, or using a racquet that is too heavy, as well as hitting wet or heavy balls or hitting into the wind. Another common racquet abnormality that causes lateral elbow extensor tendinosis is having a grip that is too large.

Biomechanics of tennis

Tennis places great stress on the shoulder and elbow. The shoulder receives most stress during the serve and overhead strokes. There is a tendency to develop impingement b a similar mechanism to the throwers and swimmers. The service action involves initial 90* abduction and external rotation in the clocking phase. The shoulder moves from external to internal rotation, from abduction into forward flexion. The deceleration or follow through phase is controlled b the external rotators. Impingement is exacerbated increased internal rotation of the shoulder in forward flexion. In comparison to pitching, the racquet dissipates much of the impact force, thus reducing force transmitted to the shoulder.

This enables the tennis player to serve more than 100 servers daily, whereas pitcher may only pitch approximately ever fourth day, in tennis there is decreased range of internal/external rotation because of the effect of the racquet. However, over time shoulder instability ma gradually develops, in pitching, there is more forceful rotational movement that leads to pitcher tends to have shoulder problems at a younger age, while the tennis player usual develops problems, later in life.

Elbow pain is extremely common among tennis players; this may be due to the dominant activity of the wrist extensors. Poor backhand technique is a major predisposing factor. The role of racquets in the development of increased force through the elbow.

2.5 CLINICAL FEATURES

2.5.1 SYMPTOMS

- The typical age of those affected is 18 to 30 years.
- Patients most typically report an insidious onset, but they will often relate a history of overuse without specific trauma.
- Symptom onset generally occurs 24-72 hours after repeated wrist extension activity.
- Delayed symptoms are probably due to microscopic tears in the tendon.
- The patient complains of pain over the lateral elbow that worsens with activity and improves with rest. The patient will also often describe aggravating conditions such as a backhand stroke in tennis.
- Pain may radiate down the posterior aspect of the forearm.
- The patient can often pinpoint pain 1.5 cm distal to the origin of the extensor carpi radialis brevis
- Pain can vary from being mild (e.g., with aggravating activities like tennis or the repeated use of a hand tool), or it can be such severe pain

that simple activities like picking up and holding a coffee cup (i.e., "coffee cup sign") will act as a trigger for the pain.

2.5.2 SIGNS

- **Inspection:** Very rarely does one notice swelling or ecchymosis.
- **Palpation:** Maximal tenderness is elicited 1-2 cm distal to the origin of the extensor carpi radialis brevis at the lateral epicondyle.
- Pain is increased with resisted wrist extension, with the wrist radially deviated and pronated.
- Resisted extension of the middle finger is also painful secondary to stress placed on the extensor carpi radialis brevis tendon, as it is preferentially stressed in this position when it must contract synergistically to anchor the third metacarpal, such that extension can take place at the digits.
- Increased pain is noted with resisted supination and hand shaking.
- Always examine range of motion of the shoulder, elbow, and wrist on the affected side.
- Examine range of motion and test for crepitus at the radiohumeral joint of the affected limb to evaluate for radiohumeral bursitis, osteochondritis of the capitulum, or Posterior Introsseus Nerve entrapment.

- If decreased range of motion if noted on physical examination, consider obtaining an x-ray to further evaluate the joint.

2.6 EXAMINATION AND TESTS

The diagnosis is made by clinical signs and symptoms, which are usually both discrete and characteristic. There should be point tenderness over the origin of the extensor carpi radialis brevis muscle from the lateral epicondyle (ECRB origin). There should also be pain with passive wrist flexion and also with resisted wrist extension (Cozen's test), both tested with the elbow extended.

MRI typically shows fluid in the extensor carpi radialis brevis origin. There may also be a defect in this tissue. The use of the word "tear" to refer to this defect can be misleading. The word "tear" implies injury and the need for repair – both of which are probably inaccurate and inappropriate for this degenerative enthesopathy.

Depending on the severity and number of small tendon injuries that build up, the extensor carpi radialis brevis may not be able to fully heal.

Nirschl defined four stages of lateral epicondylitis, showing the introduction of permanent damage beginning at Stage 2. The stages are:

1. Inflammatory changes that are reversible
2. Nonreversible pathologic changes to origin of the extensor carpi radialis brevis muscle

3. Rupture of extensor carpi radialis brevis muscle origin

4. Secondary changes such as fibrosis or calcification.

2.7 TREATMENT

In general the evidence base for intervention measures is poor.

Non-specific palliative treatments include:

- Physical Therapy- most important part of the treatment. It includes various modalities for preventing and treating tennis elbow.
- Non-steroidal anti-inflammatory drugs (NSAIDs): ibuprofen, naproxen or aspirin
- Heat or ice
- A counter-force brace or "tennis elbow strap" to reduce strain at the elbow to limit pain provocation and to protect against further damage.
- Vibration therapy can be used for localized pain relief and inflammation with a number of portable devices being available for pain relief.

Rest is the tennis player's treatment of choice when the pain first appears; the rest allows the tiny tears in the tendon attachment to heal. Tennis players treat more serious cases with ice (although the effectiveness of ice treatment has been challenged in clinical research), anti-inflammatory drugs, soft tissue massage, stretching exercises, and ultrasound therapy.

In recalcitrant cases surgery may be indicated. Many techniques have been described using open, percutaneous or arthroscopic approaches. Most techniques aim to release the strain on the extensor carpi radialis brevis muscle, remove degenerative tissue and promote healing.

Other treatments with limited scientific support include:

- Acupuncture
- Blood injection (possibly augmented by plateletpheresis)
- Botulinum toxin
- Extra-corporeal shock wave therapy
- Immobilization of the forearm and elbow using a splint for two to three weeks
- Local injection of cortisone
- Occupational therapy, primarily for stretching and strengthening of the wrist extensor musculature.
- Pulsed ultrasound to break up scar tissue, promote healing, and increase blood flow in the area
- Sclerotherapy
- Trigger point therapy

There are clinical trials addressing many of these proposed curative treatments, but the quality of these trials is generally poor.

2.8 EXERCISES AND STRETCHES

There are several recommendations regarding prevention, treatment, and avoidance of recurrence that are largely speculative including:

1. Stretches and progressive strengthening exercises to prevent re-irritation of the tendon.
2. Progressive strengthening involving use of weights or elastic theraband to increase pain free grip strength and forearm strength.
3. Racquet sport players also are commonly advised to strengthen their shoulder rotator cuff, scapulothoracic and abdominal muscles by Physiotherapists to help reduce any overcompensation in the wrist extensors during gross shoulder and arm movements.
4. Soft tissue release or simply massage can help reduce the muscular tightness and reduce the tension on the tendons.
5. Strapping of the forearm can help realign the muscle fibers and redistribute the load.
6. Use of a racket designed to dampen the effect of ball striking.

2.9 FOLLOW-UP

Return to Play

Gradual return to play is recommended, with an emphasis on the patient employing improved form to avoid aggravating activities and techniques. The athlete should be able to perform pain-free range of moton activities. Continued attention should be placed on a strengthening and conditioning program.

Complications

The most serious complication is complete tendon rupture. Such an injury often causes a palpable defect in the extensors, which results in weakness on attempted wrist extension. Frequently, the treatment of this complication is surgical repair.

Prevention

- Attention to proper form and technique will decrease the risk of developing tendinosis of the lateral elbow extensor muscles.
- Proper equipment, (ie, size and weight of racquet, size of grip, dry balls)
- Improved conditioning, improved core strength
- Gradual increase in intensity and duration of activity

For tennis players

- Adjust racquet size: Use a midsized racquet. The popular oversized racquets can put too much strain on the arm and increase the risk of injury.
- Loosen string tension: Higher string tension can increase the torque and vibration the arm experiences, thereby increasing the risk of injury.
- Adjust grip size: A grip too small or too large decreases your control of the racquet and increases your risk of injury.
- Check racquet material: Graphite racquets and nylon strings seem to decrease the torque and vibration the arm receives, thus reducing the risk of injury.

Prognosis

Although most patients with lateral epicondylitis tend to improve in 9-18 months, they need to be made aware that successful treatment may be a prolonged course. Refractory cases may need surgical intervention.

Education

Advise the athlete on proper technique and equipment. Formal sport lessons may be beneficial to prevent individuals from acquiring bad habits.

3. REVIEW OF LITERATURE

1. **Christopher R. Herd and Brent B. Meserve (2008)** systematically reviewed available literature regarding the effectiveness of manipulation in treating lateral epicondylalgia. A comprehensive search of Medline, CINAHL, Health Source, SPORTDiscus, and the Physiotherapy Evidence Database ending in November 2007 was conducted. Thirteen studies, both randomized and non-randomized clinical trials, met inclusion criteria. Articles were assessed for quality by one reviewer using the 10-point PEDro scale. Quality scores ranged from 1–8 with a mean score of 5.15 ± 1.85. This score represented fair quality overall; however, trends indicated the presence of consistent methodological flaws. Specifically, no study achieved successful blinding of the patient or treating therapist, and less than 50% used a blinded outcome assessor. Additionally, studies varied significantly in terms of outcome measures, follow-up, and comparison treatments, thus making comparing results across studies difficult. Results of this review support the use of Mulligan's mobilization with movement in providing immediate,

short-, and long-term benefits. In addition, positive results were demonstrated with manipulative therapy directed at the cervical spine, although data regarding long-term effects were limited. Currently, limited evidence exists to support a synthesis of any particular technique whether directed at the elbow or cervical spine. Overall, this review identified the need for further high-quality studies using larger sample sizes, valid functional outcome measures, and longer follow-up periods.

2. **Leanne Bisset, Elaine Beller, Gwendolen Jull, Peter Brooks, Ross Darnell and Bill Vicenzino (2006)** investigated the efficacy of physiotherapy compared with a wait and see approach or corticosteroid injections over 52 weeks in tennis elbow using a single blind randomised controlled trial. 198 participants aged 18 to 65 years with a clinical diagnosis of tennis elbow of a minimum six weeks duration, who had not received any other active treatment by a health practitioner in the previous six months. Eight sessions of physiotherapy; corticosteroid injections; or wait and see were the interventions. The main outcome measures were Global improvement, grip force, and assessor's rating of severity measured at baseline, six weeks, and 52 weeks. Corticosteroid injection showed significantly better effects at six weeks but with high

recurrence rates thereafter (47/65 of successes subsequently regressed) and significantly poorer outcomes in the long term compared with physiotherapy. Physiotherapy was superior to wait and see in the short term; no difference was seen at 52 weeks, when most participants in both groups reported a successful outcome. Participants who had physiotherapy sought less additional treatment, such as non-steroidal anti-inflammatory drugs, than did participants who had wait and see or injections. They concluded that physiotherapy combining elbow manipulation and exercise has a superior benefit to wait and see in the first six weeks and to corticosteroid injections after six weeks, providing a reasonable alternative to injections in the mid to long term. The significant short term benefits of corticosteroid injection are paradoxically reversed after six weeks, with high recurrence rates, implying that this treatment should be used with caution in the management of tennis elbow.

3. **Peter AA Struijs and his associates (2006)** compared the effectiveness of 2 protocols for the management of lateral epicondylitis: (1) manipulation of the wrist and (2) ultrasound, friction massage, and muscle stretching and strengthening exercises. Thirty-one subjects with a history and examination

results consistent with lateral epicondylitis participated in the study. The subjects were randomly assigned to either a group that received manipulation of the wrist (group 1) or a group that received ultrasound, friction massage, and muscle stretching and strengthening exercises (group 2). Three subjects were lost to follow-up, leaving 28 subjects for analysis. Follow-up was at 3 and 6 weeks. The primary outcome measure was a global measure of improvement, as assessed on a 6-point scale. Analysis was performed using independent t tests, Mann-Whitney U tests, and Fisher exact tests. Differences were found for 2 outcome measures: success rate at 3 weeks and decrease in pain at 6 weeks. Both findings indicated manipulation was more effective than the other protocol. After 3 weeks of intervention, the success rate in group 1 was 62%, as compared with 20% in group 2. After 6 weeks of intervention, improvement in pain as measured on an 11-point numeric scale was 5.2 (SD=2.4) in group 1, as compared with 3.2 (SD=2.1) in group 2. They concluded that manipulation of the wrist appeared to be more effective than ultrasound, friction massage, and muscle stretching and strengthening exercises for the management of lateral epicondylitis when there was a short-term follow-up.

4. **Geetu Manchanda and Deepak Grover (2008),** evaluated the effectiveness of movement with mobilization compared with manipulation of wrist on pain, strength, activities of daily living in patients with lateral epicondylitis. The study has an experimental design. A total of 30 patients having symptomatic lateral epicondylitis were taken and randomly assigned to one of the three groups. Group A (n=10) received mulligan mobilization whereas Group B (n=10) received wrist manipulation. Group C (n=10) acted as a control group. All the 3 groups received conventional treatment of pulsed ultrasonic therapy at 20% duty cycle, frequency 3MHz and an intensity of 1.2 W/cm^2 for 5 min, progressive resisted exercises and stretching. Fifteen treatment sessions are given. Baseline measurement of pain (visual analogue scale score), functional pain scale and strength (using weights) was taken on Day 1 and then subsequently at day 5, day 10 and day 15. The data was analyzed using the software SPSS 12.0. All the three groups show improvement in visual analogue scale score. Group A (Mulligan mobilization) and group B (wrist manipulation) lead to statistically significant improvement in strength and functional performance when compared with group C. But there was no statistically significant difference in these two parameters between

group A and B. The study concludes that both the manual therapy techniques i.e. Mulligan mobilization as well as wrist manipulation are equally effective in reducing pain, improving strength and functional performance when compared with conventional treatment regimen of giving only the stretching and resistance exercises along with pulsed ultrasonic therapy.

5. **Slater H, Arendt-Nielsen L and Wright A, Graven-Nielsen T. (2006),** investigated the acute sensory and motor effects of an movement with mobilization intervention in healthy controls with experimentally induced lateral epicondylalgia. Twenty-four subjects were randomly allocated to either a movement with mobilization or a placebo group (n=12). In both groups, to generate the model of lateral epicondylalgia, delayed onset muscle soreness (DOMS) was provoked in one arm 24h prior (Day 0) to hypertonic saline-induced pain in the extensor carpi radialis brevis muscle (Day 1). Either a movement with mobilization or placebo intervention was applied during the saline-induced pain period. Saline-induced pain intensity (visual analogue scale: VAS), pain distribution and pain quality were assessed quantitatively. Pressure pain thresholds (PPTs) were recorded at the common extensor origin and the extensor carpi radialis brevis muscle. Maximal

measures of grip and wrist extension force were recorded. In both groups (pooled data), Delayed onset muscle soreness was efficiently induced as demonstrated by a significant decrease in pre-exercise to pre-injection pressure pain thresholds at the common extensor origin (-45+/-19%) and at the extensor carpi radialis brevis (-61+/-23%; $P<0.05$), and a significant decrease in maximal grip force (-25+/-6%) and maximal wrist extension force (-40+/-12%; $P<0.001$). Moreover, both groups experienced a significant increase in muscle soreness (3.9+/-0.2; $P<0.0001$) at Day 1 compared to pre-exercise. During saline-induced pain and in response to intervention, there were no significant between-group differences in visual analogue scale profiles, pain distributions, induced deep tissue hyperalgesia or force attenuation. These data suggest that the lateral glide- movement with mobilization does not activate mechanisms associated with analgesia or force augmentation in subjects with experimentally induced features simulating lateral epicondylalgia.

6. **Bill Vicenzino and associates and their clinical commentary:** Lateral epicondylalgia or tennis elbow is a prevalent musculoskeletal disorder that is characterized by lateral elbow pain often associated with gripping tasks. The underlying pathology

remains to be fully elucidated; however, evidence indicates that the disorder does not involve an inflammatory process but rather impairments of the pain and motor systems as well as morphological changes in the structure of both the extensor carpi radialis brevis muscle and tendon. Although the most efficient management approach remains controversial, there is a growing body of literature reporting the effects and underlying mechanisms of joint manipulation in the management of lateral epicondylalgia. Evidence exists demonstrating that joint manipulation directed at the elbow and wrist as well as at the cervical and thoracic spinal regions results in clinical alterations in pain and the motor system. In addition to presenting this evidence, this paper describes proposed underlying physiological mechanisms of joint manipulation associated with the observed clinical effects. We propose that this information will be useful for the physical therapist in making clinical decisions regarding the selection of treatment technique for the management of patients with lateral epicondylalgia.

7. **Vincenzio and his associates advocated the following study**. The treatment of lateral epicondylalgia, a widely-used model of musculoskeletal pain in the evaluation of many physical therapy

treatments, remains somewhat of an enigma. The protagonists of a new treatment technique for lateral epicondylalgia report that it produces substantial and rapid pain relief, despite a lack of experimental evidence. A randomized, double blind, placebo-controlled repeated-measures study evaluated the initial effect of this new treatment in 24 patients with unilateral, chronic lateral epicondylalgia. Pain-free grip strength was assessed as an outcome measure before, during and after the application of the treatment, placebo and control conditions. Pressure-pain thresholds were also measured before and after the application of treatment, placebo and control conditions. The results demonstrated a significant and substantial increase in pain-free grip strength of 58% (of the order of 60 N) during treatment but not during placebo and control. In contrast, the 10% change in pressure-pain threshold after treatment, although significantly greater than placebo and control, was substantially smaller than the change demonstrated for pain-free grip strength. This effect was only present in the affected limb. The selective and specific effect of this treatment technique provides a valuable insight into the physical modulation of musculoskeletal pain and requires further investigation.

8. **Vincenzio B and Wright A demonstrated** the effects of a novel manipulative physiotherapy technique on tennis elbow in a single case study. A single case study design was used to investigate the effect of a novel manipulative physiotherapy technique on the pain and dysfunction which characterises tennis elbow. The technique involves the physiotherapist sustaining a lateral glide of the elbow while the patient performs an activity which usually aggravates pain. To be judged successful, the technique should abolish pain. A pain visual analogue scale (VAS) and pressure algometer were used to measure pain. Function was measured with a grip dynamometer, function visual analogue scale and pain-free function questionnaire. The study involved three phases in a ABC design. They were a 2-week pre-treatment assessment phase, a 2-week treatment phase and a 6-week post-treatment assessment phase. The patient received four treatment sessions over the treatment phase. The technique's effect was to reduce pain and increase function during and immediately after its application. Improvement in pain and function as measured by visual analogue scales was correlated ($r = -0.92$, $p < 0.0001$). The rate of pain reduction was greater than that for improvement in function. Although the single case study design limits generalization of the

results, it does provide evidence of the beneficial response obtained by use of this technique in patients affected by tennis elbow.

4. MATERIALS AND METHODOLOGY

4.1 AIM

The main aim of this study is to compare the effectiveness of wrist manipulation versus traditional physiotherapy in the management of lateral epicondylitis in sports persons.

4.2 OBJECTIVES

1. To find out the effect of wrist manipulation in reducing pain and improving function in sports persons with lateral epicondylitis.
2. To find out the effect of traditional physiotherapy in reducing pain and improving function in sports persons with lateral epicondylitis.
3. To compare the effect of wrist manipulation versus traditional physiotherapy in reducing pain and improving function in sports persons with lateral epicondylitis.

4.3 HYPOTHESES

4.3.1. NULL HYPOTHESES

Ho1 - There is no significant decrease in pain by traditional physiotherapy (group A) in sports persons with lateral epicondylitis.

Ho2 - There is no significant decrease in pain by wrist manipulation along with traditional physiotherapy (group B) in sports persons with lateral epicondylitis.

Ho3 - There is no significant difference in the reduction of pain between Group A who received traditional physiotherapy alone and Group B who received wrist manipulation along with traditional physiotherapy.

Ho4 - There is no significant difference in the functional improvement between Group A who received traditional physiotherapy alone and Group B who received wrist manipulation along with traditional physiotherapy.

4.3.2. ALTERNATE HYPOTHESES

Ha1 - There is a significant decrease in pain by traditional physiotherapy (group A) in sports persons with lateral epicondylitis.

Ha2 - There is a significant decrease in pain by wrist manipulation along with traditional physiotherapy (group B) in sports persons with lateral epicondylitis.

Ha3 - There is a significant difference in the reduction of pain between Group A who received traditional physiotherapy alone and Group B who received wrist manipulation along with traditional physiotherapy.

Ha4 - There is a significant difference in the functional improvement between Group A who received traditional physiotherapy alone and Group B who received wrist manipulation along with traditional physiotherapy.

4.4. STUDY DESIGN

Two group Pretest –Post test Experimental design

4.5. POPULATION

Sports persons with unilateral lateral epicondylitis.

4.6. SAMPLING METHOD

Purposive Random Sampling

Subjects were selected in accordance to a predetermined inclusion and exclusion criteria to ensure homogeneity of the subjects. The subjects were then randomly assigned into two groups, Group A and Group B.

4.7. SAMPLE SIZE

Total : 30 Subjects.

Group A : 15 Subjects (Traditional Physiotherapy)

Group B : 15 Subjects (Wrist Manipulation along with Traditional Physiotherapy)

4.8. INCLUSION CRITERIA

- Subjects diagnosed as lateral epicondylitis with complaints being present for at least 6 weeks and no longer than 6 months.
- Both Sexes were included.
- Age: 18 – 30 Years.

4.9. EXCLUSION CRITERIA

- Bilateral Complaints
- A definite decrease in pain for the last 2 weeks as described by the patient.
- Severe Neck (or) Shoulder problems likely to cause elbow pain.

4.10. TOTAL STUDY DURATION

6 Months

4.11. OUTCOMES MEASURED

- Pain
- Functional Outcome

4.12. MEASUREMENT TOOLS

- Visual Analogue Scale (VAS)
- Functional Improvement: Subject’s assessment of **“GLOBAL MEASURE OF IMPROVEMENT”.**

(6 Point Scale)

1 – Completely recovered

2 – Much recovered

3 – Slightly Improved

4 – Not Changed.

5 – Slightly worse

6 – Much worse

4.13. STUDY METHOD

30 subjects with unilateral lateral epicondylitis were selected and randomly assigned into two experimental groups A and B. Subjects of Group A were given traditional physiotherapy alone. Subjects of Group B were given wrist manipulation along with traditional physiotherapy. The total treatment duration was 6 weeks.

4.14. TREATMENT PROCEDURE

Treatment for Group A: (Traditional Physiotherapy)

Ultra sound, Friction massage,

Strengthening and stretching exercises

1st week – 3 Sessions

2nd week – 2 Sessions

Next 4 weeks – 1 Session per week

Subjects in this group were using a protocol that was used in a previous large-scale trial on lateral epicondylitis. During the 6-week intervention period, the subjects underwent a total of 9 intervention sessions (3 sessions during the first week, 2 sessions during the second week, and 1 session per week during the remaining 4 weeks). Every session included a 7 1/2-minute pulsed ultrasound treatment around the lateral humeral epicondyle. Pulsed ultrasound (20% duty cycle) was given with an intensity of 2 W/cm^2. In addition, subjects were treated with friction massage for approximately 10 minutes by the physical therapist. When pain subsided, subjects were instructed in muscle strengthening and stretching exercises by the physical therapist and were told to perform the exercises at home twice daily. These exercises consisted of movements against resistance, rotational exercises, and occupational exercises. All sessions ended with stretching exercises of the wrist and elbow. The exercise program is described below. These exercises were intensified in 4 steps, with increasing resistance. Subjects were allowed one step up if all exercises could be performed without pain. Subjects were instructed to use the affected elbow to their pain threshold. When pain had resolved, the intervention was stopped.

Stretching exercises for tennis elbow

Wrist flexor stretch (FIGURE.1)

1. Extend your arm in front of you with your palm up.
2. Bend your wrist, pointing your hand toward the floor.
3. With your other hand, gently bend your wrist further until you feel a mild to moderate stretch in your forearm.
4. Hold for at least 15 to 30 seconds.

   Repeat 2 to 4 times.

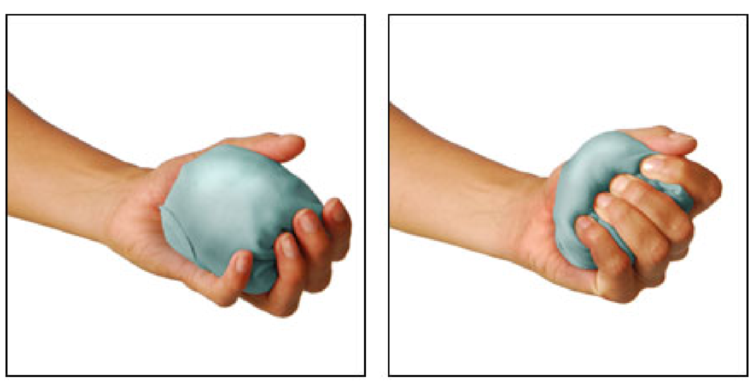
Wrist extensor stretch (FIGURE.2)

Repeat steps 1 to 4 of the stretch above but begin with your extended hand palm down.

Strengthening exercises for tennis elbow

Ball or sock squeeze (FIGURE.3)

1. Hold a tennis ball (or a rolled-up sock) in your hand.
2. Make a fist around the ball (or sock) and squeeze.
3. Hold for about 6 seconds, and then relax for up to 10 seconds.
4. Repeat 8 to 12 times.
5. Switch the ball (or sock) to your other hand and do 8 to 12 times.



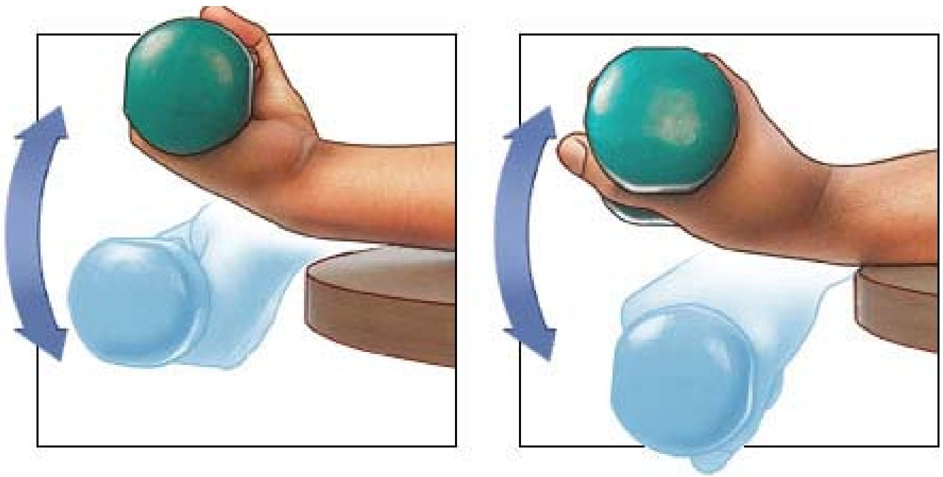
Wrist deviation (FIGURE.4)

1. Sit so that your arm is supported but your hand hangs off the edge of a flat surface, such as a table.
2. Hold your hand out like you are shaking hands with someone.
3. Move your hand up and down.
4. Repeat this motion 8 to 12 times.
5. Switch arms.

Wrist curls (FIGURE.5)

1. Place your forearm on a table with your hand hanging over the edge of the table, palm up.
2. Place a 1- to 2-pound weight in your hand. This may be a dumbbell, a can of food, or a filled water bottle.
3. Slowly raise and lower the weight while keeping your forearm on the table and palm facing up.

4. Repeat this motion 8 to 12 times.
5. Switch arms, and do steps 1 through 4.
6. Repeat with your hand facing down toward the floor. Switch arms.



Biceps curls (FIGURE.6)

1. Sit leaning forward with your legs slightly spread and your left hand on your left thigh.
2. Place your right elbow on your right thigh, and hold the weight with your forearm horizontal.
3. Slowly curl the weight up and toward your chest.
4. Repeat this motion 8 to 12 times.

   Switch arms, and do steps 1 through 4.

   Try to do this exercise twice with each hand

Friction Massage

Light to deep friction massage is given to the affected fibers of the extensor carpi radialis brevis at the anterior aspect of the lateral humeral epicondyle. The patient sits with the lower arm supported; the elbow is flexed and the forearm is supinated to allow easy access of the massaging finger or thumb. The therapist sits at the side, facing the patient one hand supports at the elbow. The massaging hand is placed so that the thumb is over the affected fibers. Counter pressure is applied by the fingers lying against the medial proximal aspect of the forearm. The thumb is drawn access the side of the lesion in a direction perpendicular to the fibers by alternate supination and pronation of the forearm, using the fingers as a fulcrum. The therapist may also use the index or long fingers for massage.

Treatment for Group B : (Wrist Manipulation along with Traditional Physiotherapy)

Traditional Physiotherapy : Same protocol as that of Group A as described above.

Wrist Manipulation

Duration : 15 – 20 Minutes.

Frequency : 2 times per week Maximum of 9 Sessions.

Subjects in this group were treated 2 times per week, with a maximum of 9 intervention sessions over the 6-week period of the study. All intervention sessions were conducted by the same physiotherapist (researcher), who was experienced in this manipulative procedure. As soon as complaints resolved, the intervention was stopped. An intervention session consisted of several manipulative maneuvers. The manipulative maneuver is a thrust technique and was performed as follows. Each subject rested the forearm of his or her affected side on a table with the palmar side of the hand facing down (refer appendix FIGURE.7A). The therapist sat at a right angle to the subject's affected side and gripped the subject's scaphoid bone between his thumb and index finger (FIGURE. 7A and 7B). He strengthened this grip by placing the thumb and index finger of his other hand on top of them.

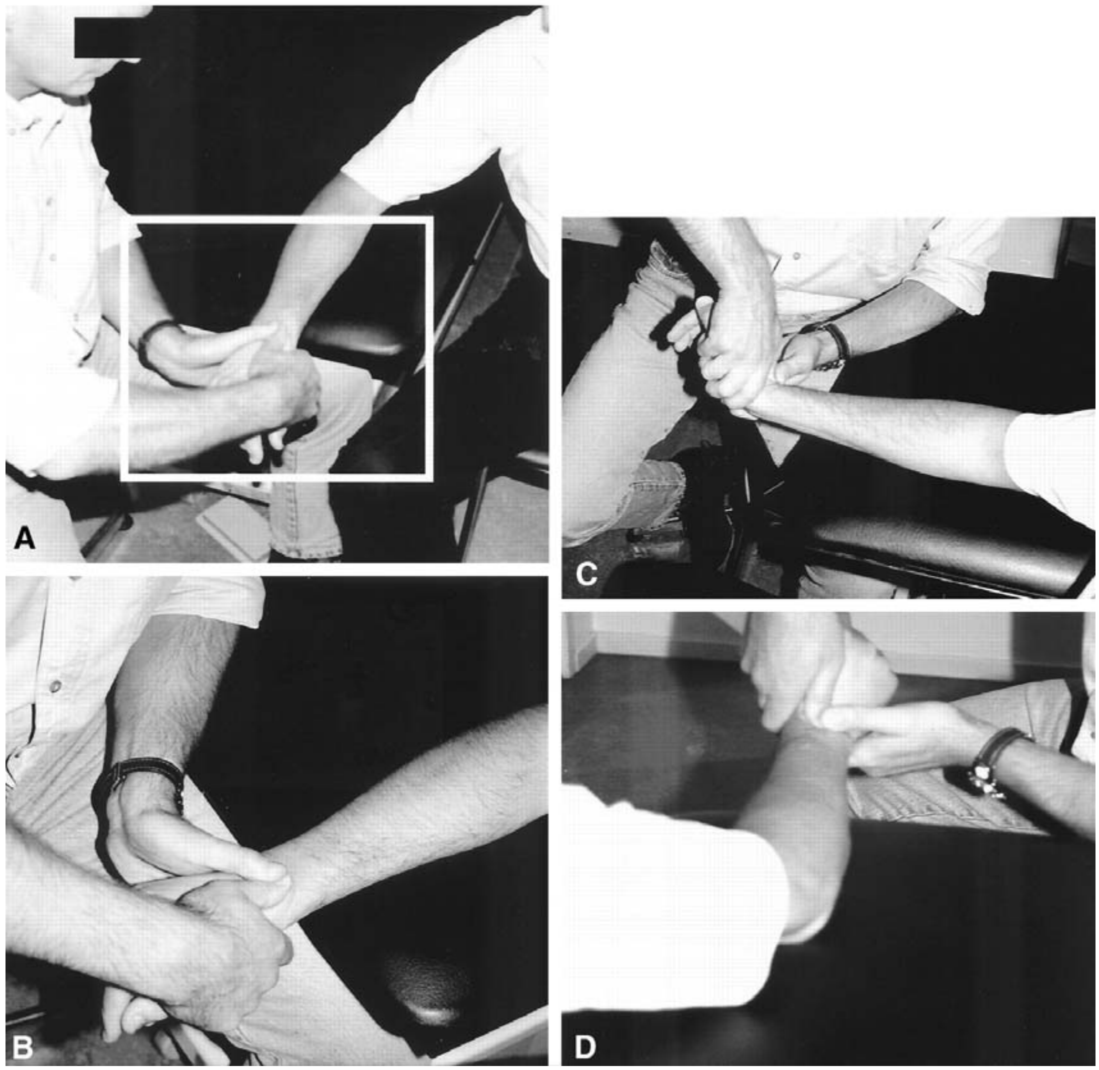


FIGURE 7

The therapist then extended the subject's wrist dorsally at the same time the scaphoid bone was manipulated ventrally (FIGURE.7C and 7D). This part of the maneuver was repeated approximately 15 times. This procedure was repeated about 20 times, alternated by either forced passive extension of the wrist or extension against resistance. The duration of an intervention session was 15 to 20 minutes. No restrictions in use of the arm were imposed. No previous descriptions of this specific maneuver were found in literature. We developed the maneuver based on the wrist treatment described by Lewit.

4.15 STATISTICAL ANALYSIS

The changes within the experimental group were analyzed using Paired't' test.

$$\text{Paired't' test} = \frac{\bar{d}\sqrt{n}}{S}$$

$$S = \sqrt{\frac{\Sigma d^2 - (\bar{d})^2 \, x \, n}{n-1}}$$

$$d = \frac{\Sigma d}{N}$$

Where,

n = Number of samples S = Standard deviation

$\bar{d}$ = Mean deviation Σd^2 = Sum of squared deviation

The difference between two groups were analyzed using Independent 't' test.

$$\text{Independent 't' test} = \frac{\bar{X}_1 - \bar{X}_2}{S} \sqrt{\frac{n_1 \, n_2}{n_1 + n_2}}$$

$$S = \sqrt{\frac{\Sigma(\bar{X}_1 - \bar{X}_1)^2 + \Sigma(\bar{X}_2 - \bar{X}_2)^2}{n_1 + n_2 - 2}}$$

Where,

$\bar{X}_1$ = Mean of group A n_1 = Number of subjects in group A

$\bar{X}_2$ = Mean of group B n_2 = Number of subjects in group B

S = Standard deviation.

5. DATA ANALYSIS AND RESULTS

5.1 PAIRED ‘t’ TEST FOR PAIN MEASURED BY VISUAL ANALOGUE SCALE

5.1.1 GROUP A (TRADITIONAL PHYSIOTHERAPY ALONE)

DEGREES OF FREEDOM	LEVEL OF SIGNIFICANCE	TABLE ‘t’ VALUE	CALCULATED ‘t’ VALUE	SIGNIFICANCE
14	5%	2.145	12.472	**P<0.05 Significant**

5.1.2 GROUP B (WRIST MANIPULATION ALONG WITH TRADITIONAL PHYSIOTHERAPY)

DEGREES OF FREEDOM	LEVEL OF SIGNIFICANCE	TABLE ‘t’ VALUE	CALCULATED ‘t’ VALUE	SIGNIFICANCE
14	5%	2.145	46.057	**P<0.05 Significant**

5.2 INDEPENDENT 't' TEST FOR PAIN MEASURED BY VISUAL ANALOGUE SCALE

DEGREES OF FREEDOM	LEVEL OF SIGNIFICANCE	TABLE 't' VALUE	CALCULATED 't' VALUE	SIGNIFICANCE
28	5%	2.048	2.150	**P<0.05 Significant**

5.3 INDEPENDENT 't' TEST FOR FUNCTIONAL IMPROVEMENT MEASURED BY "GLOBAL MEASURE OF IMPROVEMENT" ON A 6 POINT SCALE

DEGREES OF FREEDOM	LEVEL OF SIGNIFICANCE	TABLE 't' VALUE	CALCULATED 't' VALUE	SIGNIFICANCE
28	5%	2.048	1.313	**P>0.05 Not Significant**

DATA INTERPRETATION

1. PAIRED 't' TEST FOR PAIN MEASURED BY VISUAL ANALOGUE SCALE

GROUP A (TRADITIONAL PHYSIOTHERAPY ALONE)

The table 't' value for 14 degrees of freedom at 5% level of significance is **2.145**. The calculated 't' value for 14 degrees of freedom at 5% level of significance is **12.472**. Since the calculated 't' value is greater than the table 't' value we **accept** the alternate hypothesis **Ha1**. Hence there is a significant reduction of pain in Group A who received traditional physiotherapy alone. (TABLE 5.1.1)

2. PAIRED 't' TEST FOR PAIN MEASURED BY VISUAL ANALOGUE SCALE

GROUP B (WRIST MANIPULATION ALONG WITH TRADITIONAL PHYSIOTHERAPY)

The table 't' value for 14 degrees of freedom at 5% level of significance is **2.145**. The calculated 't' value for 14 degrees of freedom at 5% level of significance is **46.057**. Since the calculated 't' value is greater than the table 't' value we **accept** the alternate hypothesis **Ha2**. Hence there is a significant reduction of pain in

Group B who received wrist manipulation along with traditional physiotherapy. (TABLE 5.1.2)

3. INDEPENDENT ‘t’ TEST FOR PAIN MEASURED BY VISUAL ANALOGUE SCALE

The table ‘t’ value for 28 degrees of freedom at 5% level of significance is **2.048**. The calculated ‘t’ value for 28 degrees of freedom at 5% level of significance is **2.150**. Since the calculated ‘t’ value is greater than the table ‘t’ value we **accept** the alternate hypothesis **Ha3**. Hence there is a significant difference in the reduction of pain between Group A who received traditional physiotherapy alone and Group B who received wrist manipulation along with traditional physiotherapy. (TABLE 5.2)

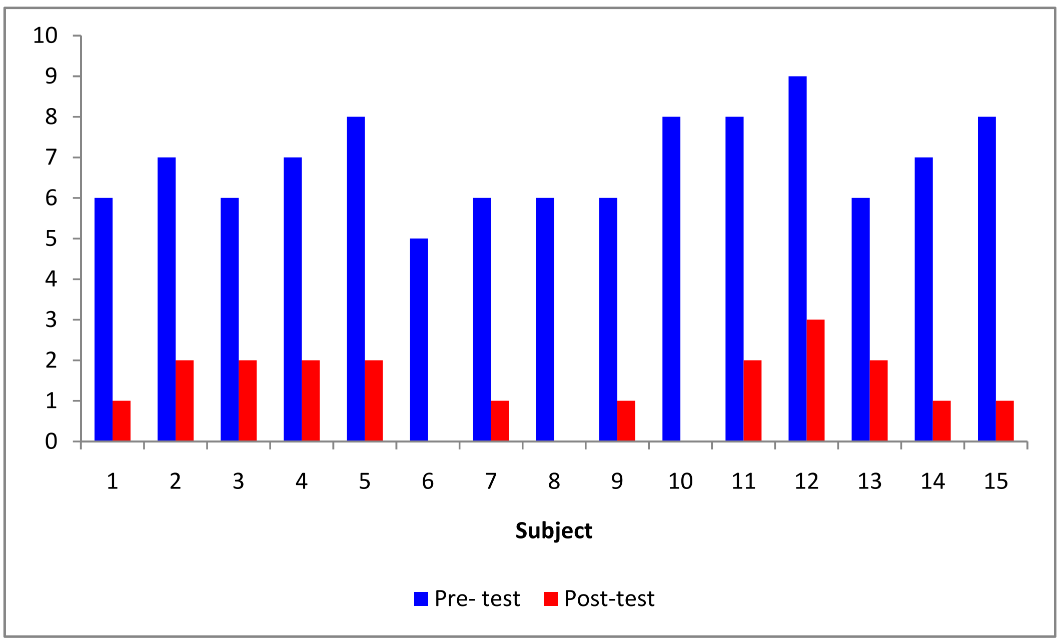
4. INDEPENDENT ‘t’ TEST FOR FUNCTIONAL IMPROVEMENT MEASURED BY “GLOBAL MEASURE OF IMPROVEMENT” ON A 6 POINT SCALE

The table ‘t’ value for 28 degrees of freedom at 5% level of significance is **2.048**. The calculated ‘t’ value for 28 degrees of freedom at 5% level of significance is **1.313**. Since the calculated ‘t’ value is lesser than the table ‘t’ value we **accept** the null hypothesis **Ho4**. Hence there is no significant difference in the functional improvement between Group A who received traditional physiotherapy alone and Group B who received wrist manipulation along with traditional physiotherapy. (TABLE 5.3)

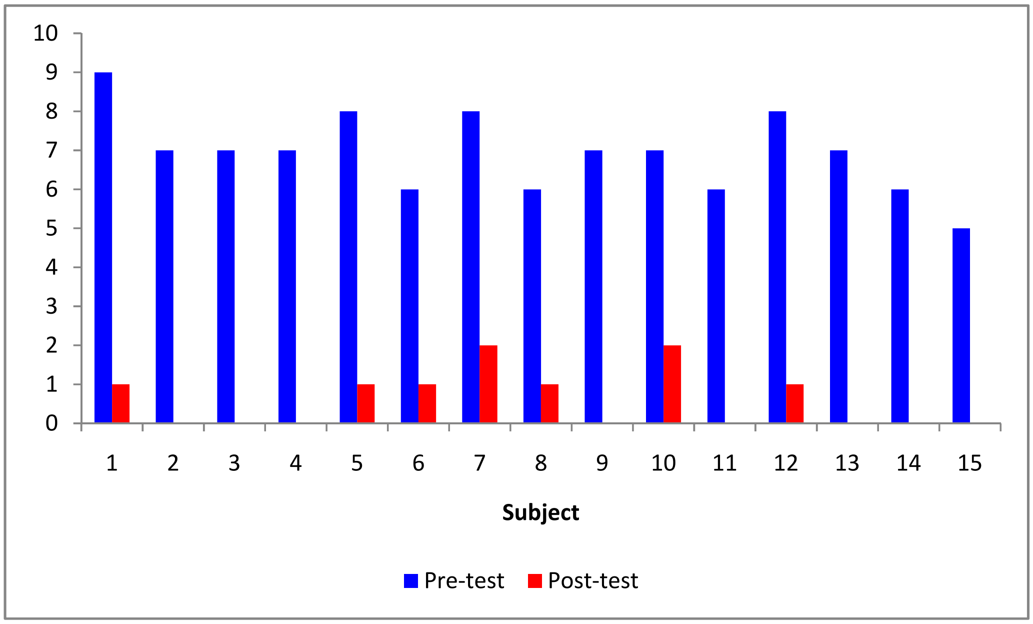
6. GRAPHICAL PRESENTATION

PAIN USING VAS

Group A



Group – B



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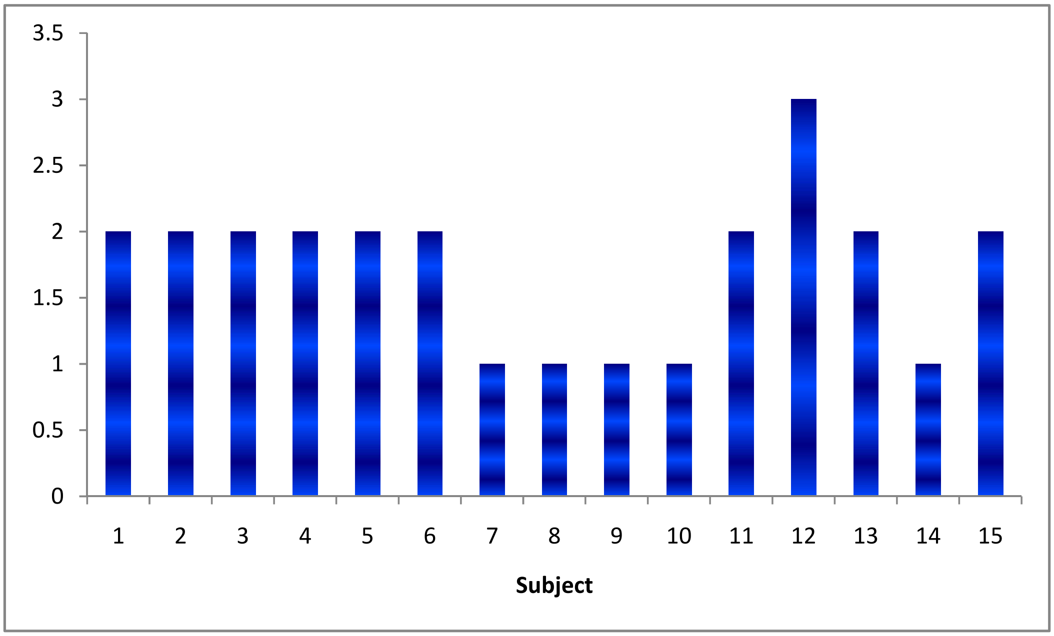
Subject
Pre-test
Post-test

FUNCTIONAL IMPROVEMENT

Post test – A



1 – Completely recovered

2 – Much recovered

3 – Slightly Improved

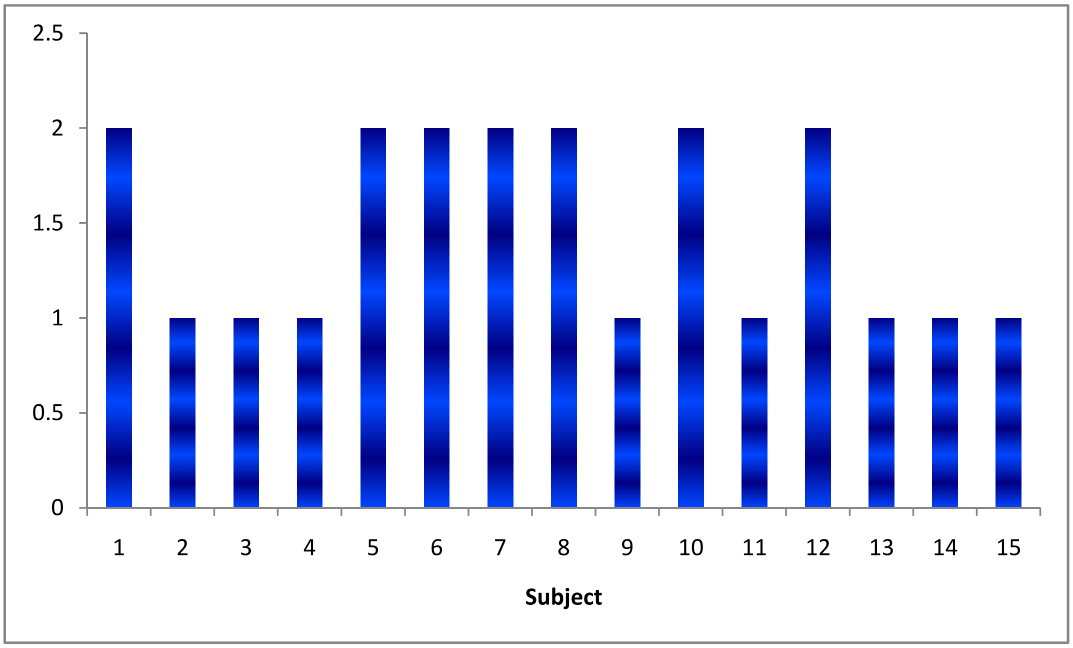
4 – Not Changed.

5 – Slightly worse

6 – Much worse

FUNCTIONAL IMPROVEMENT

Post test – B



1 – Completely recovered

2 – Much recovered

3 – Slightly Improved

4 – Not Changed.

5 – Slightly worse

6 – Much worse

7. DISCUSSION

Common extensor tendinosis of the elbow is the most frequent cause of chronic lateral elbow pain and affects both men and women. The pain is typically over the lateral aspect of the elbow at the origin of the Common extensor tendinosis and often resolves by 6 months to 1 year after onset; however, in some patients the pain can be persistent and can lead to considerable disability.

Despite the wide variety of medical and surgical therapies that have been used to treat chronic elbow tendinosis, no one therapy has gained universal acceptance. Various studies and meta-analyses have failed to show support for a definitive treatment option, with many studies producing inconsistent results.

The study showed that manipulation of the wrist might have additional treatment effects compared with ultrasound, friction massage, and muscle stretching and strengthening exercises for management of lateral epicondylitis over the short term. Statistically significant differences between groups were found for the outcome measure, pain using visual analogue scale after 6 weeks of intervention, indicating that manipulation was more effective than traditional physiotherapy (tables 5.1 and 5.2).

But the outcome measure of functional improvement (global improvement) was no longer statistically significant between the groups after 6 weeks of intervention (table 5.3). This finding was most likely due to the small number of subjects included, resulting in a low power. This low power led to a great chance of a type II error in the study. The small sample size and the resulting low power of the study implies that caution must be used in drawing definitive conclusions about the relative effectiveness of the two interventions used in our study.

From the results of the study, we believe that both the groups showed significant improvement in pain reduction. There was no statistically significant difference between both groups in functional improvement which is attributed to the type II error. We believe that both traditional physiotherapy and manipulation are effective in the management of lateral epicondylitis in sports persons. However manipulation was more effective in pain reduction than traditional physiotherapy. The effects of manipulation over pain reduction cannot be disregarded.

Since no statistically significant difference in functional improvement between the two groups was found no definitive conclusion can be drawn about the relative effectiveness of the interventions in functional improvement. Further research should be conducted, but until such research is reported, this study can be used to guide intervention.

The shortcomings of this study include a variety of factors. Small sample size is attributed to type II error. Another shortcoming of our study was that only short-term effects were investigated. Although often patients are mainly interested in a fast recovery, effects over the long term might be less distinctive due to, for example, recurrence of complaints. In terms of baseline characteristics, difference between groups were present for the male/female distribution and duration of complaints. These differences may have introduced bias; however, sex has not been reported to be a prognostic factor for effectiveness of interventions.

Despite its broad application, the mechanism by which manipulation may work is poorly understood. Manual therapy is used quite often for the spine and peripheral joints, despite of the inability of clinicians to accurately diagnose the pathway at which a manipulation is targeted. The advantages of the manipulation of the wrist are the potential effectiveness over the short term and the ability for the patient to maintain his or her daily activities without restrictions. In addition, manipulation might be more cost-effective due to reduction in the number of treatments needed. Considering the relatively high prevalence of the injury, this cost-effectiveness might lead to a major cost-reduction for the players.

8.LIMITATIONS AND SUGGESTIONS

1. The sample size was small. Future studies with a larger sample size are recommended.
2. This study focused only on the short-term effects. Future studies with a long term focus are recommended.
3. The population was restricted to sports persons. Similar studies with other groups with lateral epicondylitis can be carried out.
4. The absence of a control group led to ineffectiveness of comparisons between the interventions. Further, future studies must include a control group to enable effective comparisons between the interventions.
5. This study was restricted to only two outcome measures. Several other outcome measures can be measured using various other tools.
6. A cost-effectiveness study could be carried out in the future.

9.CONCLUSION

The promising results of this comparative study need replication in a large-scale randomized clinical trial that would include a control group and longer follow-up. The trial should be sufficiently powered and should compare manipulation of the wrist with the most commonly used and potentially effective conservative intervention strategies for lateral epicondylitis. Validated outcome measures should be used and evaluated over the short-term, intermediate term and long term. More physical therapists should be included, and inter-performer variability (variability in effectiveness of the manipulation among different therapists, as determined by means of a learning curve for application of the intervention) should be studied. In addition to the analysis of the effectiveness of the compared intervention strategies, a cost-effectiveness analysis should be incorporated in the trial, because reduced costs are an important advantage of the manipulative treatment. The analysis should concentrate on both direct and indirect costs.

Thus it can be concluded that both traditional physiotherapy and wrist manipulation are effective in the management of lateral epicondylitis in sports persons. Manipulation has an additional greater effect on pain reduction.

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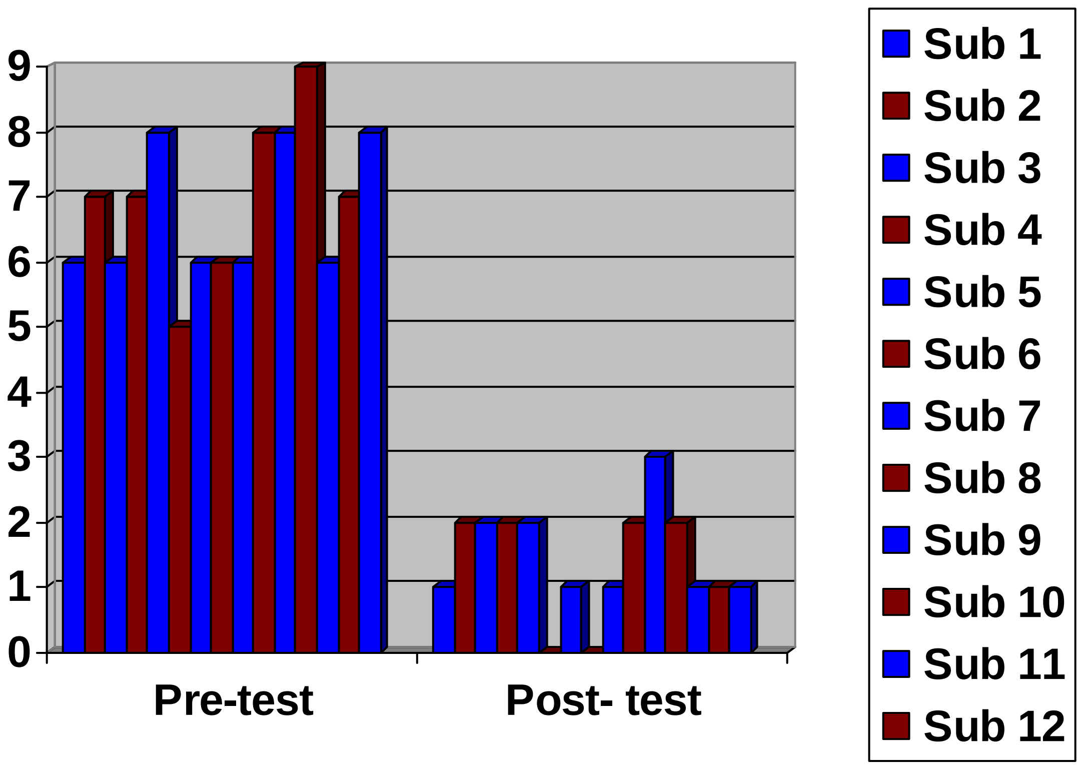
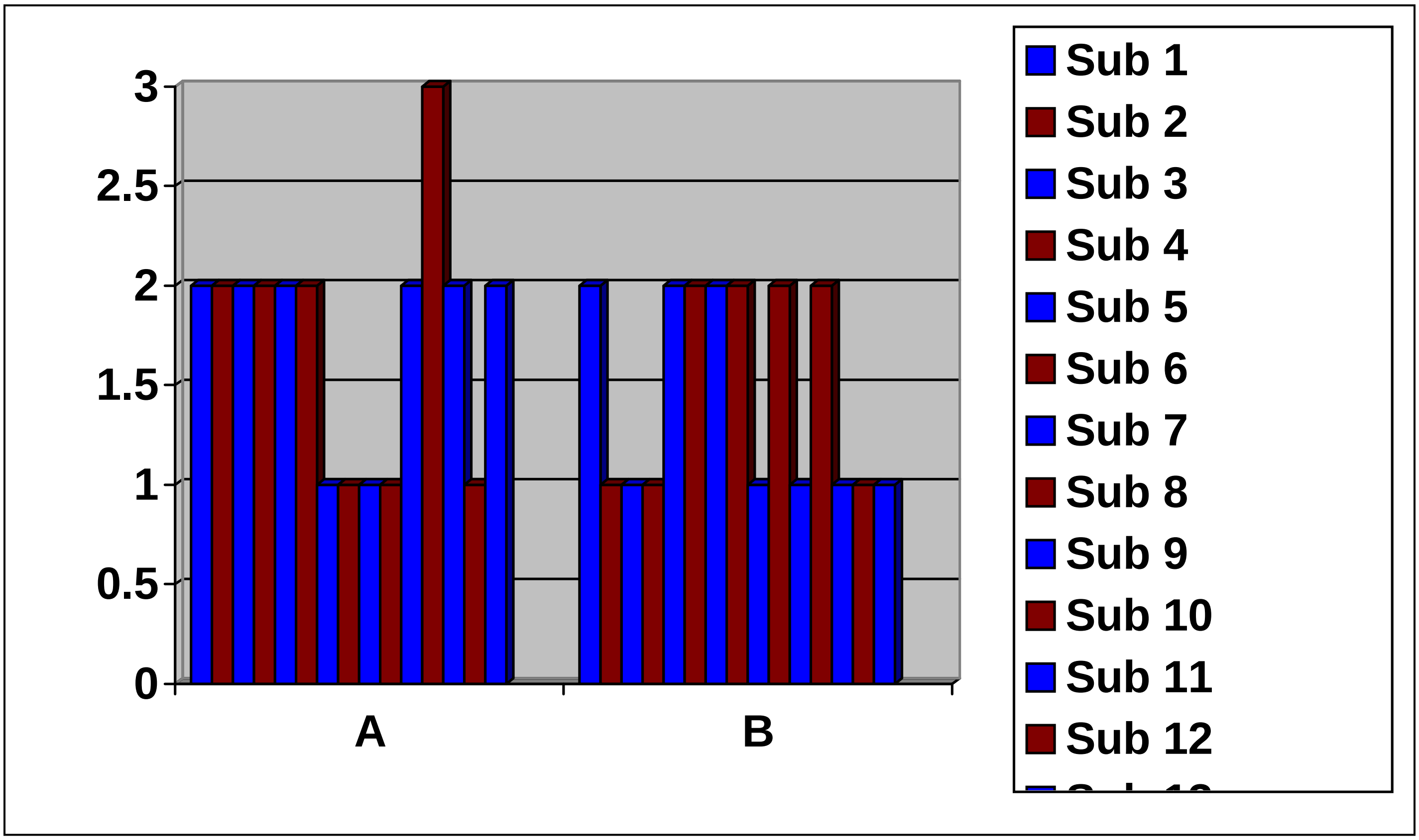
Pain Using VAS

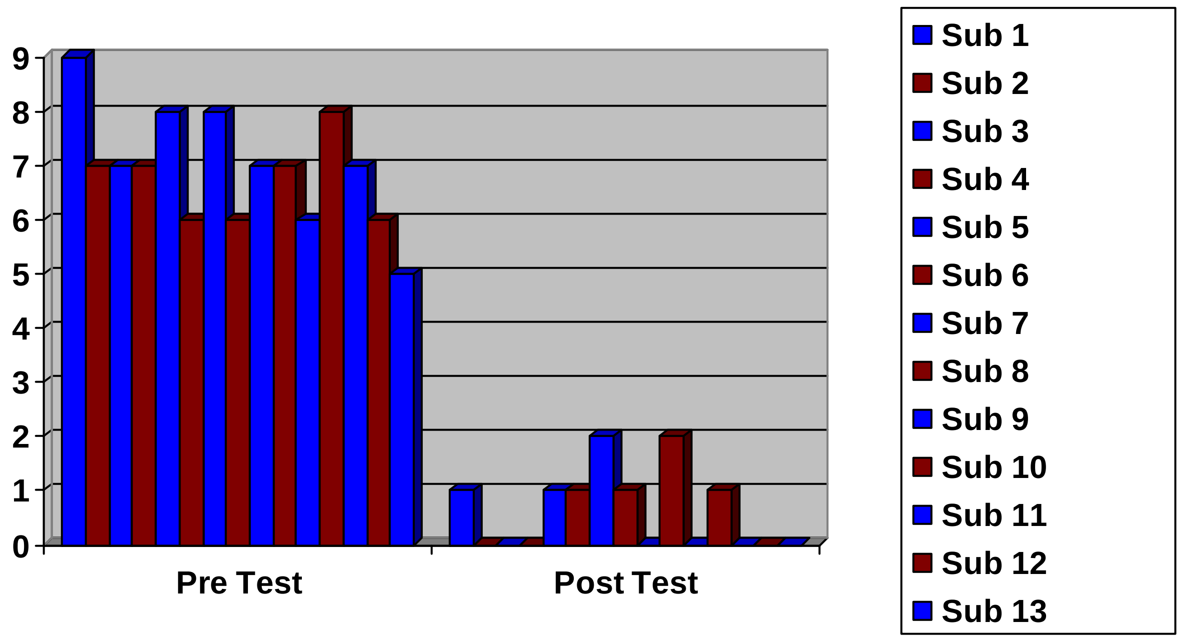


Functional Improvement



1- Completely Recovered
2- Much Improved
3- Slightly Improved
4- Not Changed
5- Slightly Worse
6- Much Worse

B TEST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